WHAT IS CLAIMED IS:

1. An intelligent hydraulic actuator for use in an injection molding machine which has a system controller, the actuator comprising:

a hydraulic actuator for moving in a linear or rotary manner between first and second positions in response to hydraulic fluid flow or to generate a required torque or force, to move a controlled injection molding structure; and

a microcontroller disposed adjacent said actuator, for causing said actuator to move between the first and second positions, said microcontroller being coupled to the system controller.

2. An actuator according to Claim 1, further comprising a hydraulic manifold for supplying hydraulic fluid to said hydraulic actuator, said microcontroller being disposed adjacent said manifold.

3. An actuator according to Claim 1, wherein said hydraulic actuator has a valve for controlling flow of hydraulic fluid to said actuator, said microcontroller being disposed adjacent said valve.

4. An actuator according to Claim 1, further comprising a valve for controlling the flow of hydraulic fluid to said hydraulic actuator, said valve having an analog driver, said microcontroller having a digital-to-analog converter to provide analog signals to said analog driver.

5. An actuator according to Claim 1, further comprising a sensor for sensing an operational parameter

of said hydraulic actuator, said sensor providing a feedback signal to said microcontroller.

6. An actuator according to Claim 1, wherein said microcontroller includes a memory device for storing at least one of (i) control signals for said hydraulic actuator, (ii) feedback signals from said hydraulic actuator.

7. An actuator according to Claim 1, wherein said microcontroller performs closed-loop control of said hydraulic actuator by applying an inverse function of a non-linear characteristic of said hydraulic actuator.

8. An actuator according to Claim 1, further comprising a valve for controlling a flow of hydraulic fluid to said hydraulic actuator, and wherein said microcontroller stores a characteristic of hydraulic fluid flow vs. valve stroke at a predetermined pressure drop, and wherein said microcontroller determines flow through said valve based on a detected pressure drop and the stored characteristic.

9. An actuator according to Claim 1, further comprising first and second proportional valves for controlling the flow of hydraulic fluid to said hydraulic actuator, and wherein said microcontroller controls said first and second proportional valves to provide regenerative and non-regenerative control of said hydraulic actuator.

10. Apparatus for controlling a hydraulic actuator in an injection molding machine having (i) a hydraulic manifold for supplying hydraulic fluid to the hydraulic actuator, (ii) a system control processor, and

(iii) at least one sensor for sensing an operational condition associated with the hydraulic actuator, said apparatus comprising:

a processor which controls movement of the hydraulic actuator, said processor having a memory for storing at least one control program which said processor runs to control said movement, said processor being coupled to the manifold;

a command input which provides command signals from these system control processor to said processor; and

a control output which provides control signals from the microcontroller to the hydraulic actuator.

11. Apparatus according to Claim 10, wherein said processor generates said control signals using said at least one control program.

12. Apparatus according to Claim 10, wherein said processor generates said control signals using the command signals.

13. Apparatus according to Claim 10, wherein said processor has a feedback input which receives feedback signals from a least one sensor, and wherein said processor generates the control signals using the feedback signals.

14. Apparatus according to Claim 13, wherein said memory stores a plurality of control program, and wherein said processor uses the feedback signals to select one of the plurality of control programs to control the movement of the hydraulic actuator.

15. Apparatus according to Claim 10, wherein said processor controls movement of a plurality of hydraulic actuators, and wherein said memory stores at least one control program for each of said plurality of hydraulic actuators.

16. Apparatus according to Claim 10, wherein said processor has at least one feedback input which receives at least one feedback signal from at least one sensor, and wherein the processor memory stores the feedback signal(s).

17. An injection molding machine comprising:

a plurality of molding devices which perform an injection molding operation;

a system control processor for causing said plurality of molding devices to perform the injection molding operation;

a plurality of hydraulic actuators for respectively moving said plurality of molding devices;

a plurality of valves for respectively providing hydraulic fluid to said hydraulic actuators to move the plurality of molding devices;

a manifold which provides hydraulic fluid to the plurality of valves; and

a processor, disposed adjacent at least one of (i) said manifold and (ii) at least one of said plurality of valves, and being coupled to each of said plurality of valves and to said system control processor, said processor storing a control program for each of said plurality of hydraulic actuators, said processor controlling said plurality of valves based on the stored control programs and command signals received from said system control processor.

18. A machine according to Claim 17, further comprising a plurality of sensors for monitoring said plurality of hydraulic actuators and providing a plurality of feedback signals to said processor, and wherein said processor controls the plurality of valves using the feedback signals and the control programs.

19. A machine according to Claim 18, wherein said processor performs closed-loop control of each valve based on the feedback signals and the control programs.

20. A method of controlling a hydraulic actuator which is supplied with hydraulic fluid from a controllable valve and a manifold, comprising the steps of:

disposing a microcontroller adjacent the manifold;

storing in the microcontroller the control program for controlling a movement of the hydraulic actuator;

providing to the microcontroller feedback signals from at least one sensor which senses a performance characteristic associated with the hydraulic actuator;

providing to the microcontroller command signals from the system control processor;

calculating, in the microcontroller, control signals to control the valve to cause movement of the hydraulic controller, said microcontroller being capable of calculating the control signals based on one or more of the feedback signals, the command signals, and the stored control program; and

transmitting the control signals to the controllable valve.

21. A method according to Claim 20, wherein the step of disposing the microcontroller comprises the step of mounting the microcontroller on the manifold.

22. A method according to Claim 20, further comprising the steps of:

storing, in the microcontroller, the feedback signals; and

transmitting the stored feedback signals from the microcontroller to the system control processor.

23. A method according to Claim 23, further comprising the step of controlling a plurality of hydraulic actuator valves with said microcontroller.

24. A method according to Claim 20, wherein said microcontroller performs closed-loop servo control of the controllable valve based on the stored control program and the feedback signals.

25. A method according to Claim 20, wherein the microcontroller generates control program data based on the feedback signals.

26. A method according to Claim 20, further comprising the step of transmitting control program data to the microcontroller from the system control processor.

27. A method according to Claim 20, wherein said microcontroller controls said controllable valve to cause linear or rotary movement of said hydraulic actuator.

28. A method according to Claim 20, wherein said microcontroller controls said controllable valve to

linearize nonlinear characteristics of said hydraulic actuator.

29. A method according to Claim 20, wherein the hydraulic actuator has an additional controllable valve, and wherein said microcontroller controls both controllable valves to provide regenerative and non-regenerative control of said hydraulic actuator.

30. Apparatus for controlling nonlinear characteristics of a hydraulic actuator having a valve and a feedback sensor, comprising:

a memory for storing multi-dimensional data regarding operational characteristics of the valve; and

a processor for (i) receiving feedback signals from the feedback sensor, (ii) determining operational data from the multi-dimensional data stored in the memory based on the received feedback signals, (iii) generating control signals by applying an inverse function to the operational data to control for nonlinear characteristics of the hydraulic actuator, and (iv) outputting the control signals to the valve.

31. Apparatus for controlling a hydraulic actuator, comprising:

a first valve coupled to the actuator and causing movement of the actuator by controlling movement of hydraulic fluid through said first valve;

a second valve coupled to both said first valve and the actuator and causing movement of the actuator by controlling movement of hydraulic fluid through the said first valve and the second valve; and

a microcontroller, disposed adjacent the valves, which controls said first valve and said second valve to cause regenerative control of said actuator.

32. At least one computer-readable storage medium storing an instruction set which causes a microcontroller to control a hydraulic actuator in an injection molding machine by performing the steps of:

storing a control program which provides control signals based on feedback signals from a sensor which monitors an operational parameter of said actuator;

receiving feedback signals from the sensors;

receiving command signals from an injection molding system control processor;

modifying the stored control program based on the received command signals;

generating actuator control signals based on one of the stored control program and the modified stored control program; and

outputting the actuator control signals to the actuator.